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COMMENTS OF SIGMAONE  
IN RESPONSE TO REQUEST FOR WAIVER OF  
AT&T WIRELESS SERVICES, INC.

JUN 8 2001

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas  
Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street, NW  
Washington, DC 20554

RE: Ex Parte Communication in CC Docket 94-102

Dear Ms. Salas:

SigmaOne Communications Corporation (hereinafter "SigmaOne") hereby submits the following *ex parte* comments regarding the "Partial Response of AT&T Wireless Services Inc. to Order of the Wireless Telecommunications Bureau" filed on May 30, 2001. The Order to which AT&T is responding, DA 01-1188, was released May 10, 2001, and requires AT&T to submit additional information in support of its pending Request for Waiver.

In commenting on the AT&T waiver request, and in particular on the data or lack of data submitted by AT&T in its April 4<sup>th</sup> filing and subsequent May 30<sup>th</sup> "partial response" to the FCC order, SigmaOne has submitted the following documents: 1) Exhibit A – A Detailed Response to the Major Claims Presented by AT&T in its April and May filings; 2) Exhibit B - Overview of SigmaOne and Summary of Carrier Audited AMPS/TDMA Field Trials and; 3) Exhibit C – Merits and Limitations of RSSI/MAHO based location determination – Theoretical analysis and field test results.

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### Summary and Conclusions:

SigmaOne believes that the AT&T waiver request for its TDMA and AMPS networks should be denied for the following reasons:

- Since AT&T's MNLS test results have not been made public, it is not possible to assess their accuracy claims. However based on our own internal analysis and simulations, AT&T's statement regarding the location accuracy of its proposed MNLS approach has limited theoretical basis. SigmaOne's analysis, simulations and initial field tests suggest that an accuracy of 250m-67% and 750m-95% is unachievable in a real world environment. Based on SigmaOne's own field testing utilizing RSSI/MAHO measurements the achievable accuracy of MNLS may even be worse than 1000m-67% when test conditions include real world rural, urban and suburban, indoor, outdoor, mobile and stationary scenarios.
- AT&T has failed to provide a detailed roadmap to full and timely compliance with the FCC's E-911 accuracy requirements. Specifically AT&T has failed to provide a detailed plan for how it will transition millions of its TDMA and AMPS subscribers to GSM. It is easy to speculate that this transition period will extend well beyond the next 5 years. By definition AT&T has also failed to demonstrate how it plans to transition its TDMA subscribers from a low accuracy MNLS solution to an FCC compliant location solution. Assuming the full deployment of a GSM overlay by the end of 2002 (a fact not in evidence), the vast majority, perhaps up to 10 million subscribers, will be using AT&T's TDMA networks for many years to come. Given AT&T's decision to both maintain its TDMA network and continue to sell TDMA service for an indefinite period of time, the approval of AT&T's waiver request regarding its AMPS and TDMA networks and the adoption of an MNLS solution would impose a second class location solution on millions of AT&T subscribers and thousands of PSAPs for years to come.

- AT&T's claim that the performance of network-based solutions are comparable to the "expected" performance of MNLS is not correct or accurate. Results from SigmaOne's carrier audited AMPS/TDMA field trials (carrier identity withheld due to NDA) demonstrate that the SigmaOne location system, even in its beta stage, clearly met the 67% FCC requirement in suburban environments, fully met the 95% FCC requirement across all environments and achieved 110 m-67% accuracy when test results were compiled across all environments (suburban, urban and rural). These results represent an accuracy that is more than two times better than claimed by AT&T and will be many times better than the accuracy that AT&T will actually achieve with its proposed MNLS system. Moreover, the tests conducted last year by SigmaOne do not reflect the additional hardware and algorithm improvements that have already been incorporated into the next generation commercial Sigma 5000 location system.
- AT&T's claim that it would need to deploy two location systems as it overlays GSM is incorrect. Most network based location systems including SigmaOne's, are air interface agnostic and through minimal software changes could simultaneously support both TDMA and GSM location.
- SigmaOne's carrier audited field trials and test results, as well as field trials conducted in cooperation with NENA by other location technology suppliers, provides additional evidence that technologies exist today that will far better serve the public's interest than the MNLS solution proposed by AT&T. These tests further challenge AT&T's assertion that the unsubstantiated accuracy predicted for MNLS is in any way comparable to those presented in Exhibit B.

- AT&T apparently filed their waiver request prior to obtaining substantive proof to their claim of accuracy. To date, despite the Commission's request, AT&T has still not disclosed trial results from even one of the four tests it had cited in its April 4<sup>th</sup> filing as evidence supporting the accuracy claims for its MNLS solution.
- AT&T's claim of similarity with VoiceStream approved waiver is misstated. VoiceStream has committed to a detailed roadmap to achieving full compliance for their entire subscriber base over a well-defined period of time. Unlike AT&T, Voicestream proposes to use NSS as a short term measure and then rapidly migrate to E-OTD. Under its waiver request, AT&T proposes MNLS for the vast majority of its TDMA subscriber base and no solution whatsoever for its remaining AMPS subscribers for years to come.
- The systems proposed by AT&T do not include Phase II solutions for wireless subscribers placing calls in the AMPS mode. AMPS continues to be used extensively by roamers, un-initialized handsets, and millions of subscribers throughout the United States. The absence of an AMPS location solution will significantly disadvantage wireless subscribers in rural and smaller market areas. The SigmaOne location system fully supports both AMPS and TDMA and provides comparable accuracies for both air-interfaces.
- The SigmaOne AOA antenna arrays<sup>1</sup>, are less than 1/6<sup>th</sup> of the size quoted by AT&T in its waiver request. The SigmaOne antennas were designed to be minimal in size and weight and unobtrusive (35"W x 9.5" H x 18 lb). We therefore believe that the impacts associated with such antenna installations are negligible and constraints on any zoning regulations are minimal.

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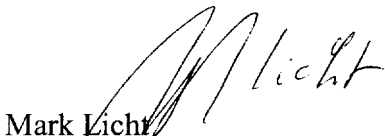
<sup>1</sup> See Photo in Exhibit B to this filing

Accordingly, SigmaOne requests that the FCC deny AT&T's waiver request for its AMPS and TDMA networks and require that it move expeditiously to deploy location solutions that meet both the letter and spirit of the Commission's mandate. Over the past five years the FCC, the public safety community, wireless carriers, and location technology providers have devoted a great deal of time, money and energy towards creating a regulatory framework by which the Phase II E911 location requirement will become a reality. Years of effort have gone into the formulation of accuracy requirements for Phase II E911 implementation and the development and testing of location technologies. Notwithstanding the assertions made by AT&T, the FCC's long-standing assumption that there are viable and acceptable location solutions in the marketplace that are deployable and acceptable within the FCC guidelines are in fact correct. After five hard years of development and testing and only five months before the mandate deadline, it is time for the industry to move forward.

Unless the FCC moves quickly to deny this request, a precedent will be set that could bring to a grinding halt any progress toward real world deployment of Phase II location solutions. We urge the Commission to take whatever additional steps it believes are now necessary to ensure that vendors, public safety and carriers immediately begin deployment of these life saving location technologies for millions of wireless subscribers throughout the United States.

If you have any questions concerning this filing, please do not hesitate to contact the undersigned.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "M. Licht", is written over the printed name "Mark Licht".

Mark Licht  
PRESIDENT  
SigmaOne Communications Corporation



**EXHIBIT A**

**DETAILED COMMENTS BY SIGMAONE  
IN RESPONSE TO AT&T'S WAIVER REQUEST**

## **1. INTRODUCTION**

On April 4, 2001, AT&T Wireless Services, Inc. submitted a request for waiver of the E911 Phase II location technology implementation rules ("Waiver Request"). In that request, AT&T proposed the use of a Mobile-Assisted Network Location System (MNLS) technique for location in its existing TDMA networks. AT&T Wireless also stated that the "accuracy expected" for MNLS will be 250m-67% of the time and 750m-95% of the time. On May 10<sup>th</sup>, the FCC issued an order requiring AT&T to provide detailed information on the performance of the proposed MNLS solution including the test results that were cited in their waiver request. On May 30<sup>th</sup>, AT&T filed a "partial response" providing no additional technical information or the required test results, stating that it would provide "additional information on the accuracy of MNLS and other information" when it submits the trial results. AT&T claims that the field trial results are still being compiled and analyzed and that AT&T will submit the final results to the Wireless Bureau shortly.

## **2. MNLS: REAL LOCATION SOLUTION?**

Until its April 4, 2001 filing, AT&T Wireless had made no previous mention of MNLS. The performance justification for MNLS continues to be based on still undisclosed and un-audited summaries of data from AT&T Wireless. AT&T claims that since trial data from some vendors using other technical approaches may, in some instances, not satisfy the FCC mandate, the use of MNLS (which SigmaOne believes to be un-proven and un-reliable) is justified.

In their submitted report from November 9<sup>th</sup> 2000, AT&T provided a detailed status of their Phase II efforts to investigate "location service technologies of all types, including:

- Network-Overlay (including Time Difference of Arrival [TDOA], Angle of Arrival [AOA], and combinations of TDOA and AOA)
- Radio Frequency Pattern Matching



- Handset (including GPS Standalone, and GPS Assisted)
- Hybrid (including Enhanced-Observed Time Difference of Arrival [E-OTD]).”<sup>2</sup>

In their conclusion, AT&T Wireless stated, “AT&T is not in a position to choose between a handset and network overlay solution.”<sup>3</sup> No mention was made of MNLS as either a possible alternative or a viable network overlay location solution.

In AT&T’s amended report filed December 6, 2000, they once again presented the status of their efforts to meet the Phase II E911 requirements.<sup>4</sup> Again, no mention or reference was made to any technical investigation or field-tests utilizing MNLS.

The exhibit also claims “AWS has been investigating MNLS since early 1997 as a possible solution to locating E911 callers. “We have conducted, participated in or reviewed multiple trials including the following:

1. Trial in Kirkland, WA by AT&T Wireless in 1997
2. Trial by Nortel Networks in 1998
3. Trial in Stockholm by Ericsson in 2000
4. Trial in Redmond, WA by AT&T Wireless in 2001.”<sup>5</sup>

Although AT&T has formally filed for a waiver request, stating that it has conducted, participated or reviewed multiple trials and has formally predicted an accuracy based on these tests, it is unwilling or unable to disclose the results of three of the four tests cited. If AT&T was still compiling and analyzing its test results in April when it filed its waiver request it is unclear what was the technical foundation for its claims. Furthermore, what is preventing AT&T from disclosing test results that were

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<sup>2</sup> AT&T Wireless Services, Inc., E911 Phase II Report, November 9, 2000, page 3.

<sup>3</sup> ID, page 10.

<sup>4</sup> AT&T Wireless Services, Inc. Amended E911 Phase II Report, December 6, 2000

<sup>5</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules, Exhibit G, page 8.

completed in 1997, 1998 and 2000 that were also cited as a basis for its accuracy prediction.

Based on the record, SigmaOne must conclude that the MNLS solution has been proposed with the goal of reducing deployment costs for what SigmaOne believes is a dramatic and unnecessary degradation in performance at the expense of both wireless consumers and the public safety community.

Since AT&T has presented no audited MNLS test summaries in an open forum for industry comment, it is difficult for an objective review of all approaches to be assessed or evaluated. Since AT&T only chose to provide results of their network technology trials and not their MNLS trials, we are still left to guess as to the relative merits of the MNLS approach.

### **3. MNLS WILL NOT ACHIEVE PROMISED ACCURACY**

The deficiencies of using radio signal strength indicators “RSSI” for determining a user’s position are well known and well documented (please refer to Exhibit C to this filing for a more complete technical analysis). Technical investigations have been ongoing since the 1970’s to determine whether such techniques are capable of producing desired location measurements. Although SigmaOne and other network vendors have previously analyzed RSSI as a tool to determine location, it has been repeatedly rejected both in terms of theoretical and practical limitations.

In their submittal “Exhibit G – Mobile-Assisted Network Location Systems (MNLS)” AT&T attempts to present a simple overview of their approach based upon mobile-assisted handoff (MAHO). However, AT&T fails to address many of the fundamental limitations with this approach. In the attached ‘Exhibit C’ we provide some details regarding the practical and theoretical limitations of this approach.

Based on their own statements it appears that even AT&T may have doubts regarding the expected performance of its proposed MNLS system. Throughout its filing, predictions and promises are always carefully couched in generalities and with caveats.

The accuracy is stated as “approximate accuracies expected.” The values of 250m-67% and 750m-95% are documented as “approximate.”

### **3.1. Simulations and Test Results**

In our sample simulation (Discussed in Exhibit C), using an optimistic set-up of 12 cell sites with a separation of no more than 1 mile between any two sites, we found errors in the order of 1000m to 1500m-67%. Such results are 6 times worse than the accuracies postulated by AT&T. Additionally, this simulation did not consider real world conditions and cell site separations (i.e., rural areas), which are most certain to degrade the accuracy further. In scenarios where the number of visible sites is limited, the location accuracy of this technique could easily approach that of cell sector, 1000-3000 meters.

SigmaOne has summarized data recorded from a total of 12 tests that were performed in order to verify the theoretical performance of RSSI/MAHO measurements as the basis for location. The overall error statistics achieved in those trials are summarized in Table 1.

**Table 1 - Overall Test Summary**

Location Error Summary	All Tests
67% of range errors were below:	922 meter
95% of range errors were below:	2112 meter

MNLS will also be limited in its ability to deliver usable location information in difficult rural settings. In fact, MNLS may not be able to provide any location information in scenarios in which only two cellular sites are visible to the handset. SigmaOne believes and has demonstrated that a combination of AOA and TDOA does provide usable location data even in rural settings.

Understanding these fundamentals, SigmaOne went on to develop a more realistic network overlay approach that includes both AOA and TDOA measurement processing.

### **3.2. Computation of Range From RSSI Is Highly Unreliable**

The presence of signal fading, which is inherent to all cellular and PCS environments, limits the ability to associate signal power with range. Fading can routinely vary the received signal strength by as much as 30-40dB from mobile movement (or reflector movement) of only one half-wavelength (about 7 inches at cellular frequencies and about 3-4 inches at PCS). This means that the instantaneous signal strength of a mobile at any point in time is practically a random number. Statistically speaking, over many averages and many positions, the mean signal strength has some degree of repeatability. However, even vendors of RF planning simulation tools will not commit to prediction accuracies of better than 6-8dB. The impediment to determining the precise location of a wireless handset is that any one or even a few measurements will have almost no degree of repeatability, and the high degree of signal strength fluctuation will certainly prohibit reliable measurements.

A wide range of variables affect the RSSI measurements performed in the handset. These include:

- 1) **Multipath.** Changes in the location of a handset in the order of a single wavelength (12 inches or less), may cause variations of signal strength of up to 30 dB, which significantly alter the range calculation.
- 2) **Interference.** Interference power is indistinguishable from the target signal in conventional MAHO measurements, thus corrupting RSSI accuracy.
- 3) **Handset Antenna Directionality.** Variation in the signal strength is significant based upon antenna orientation and the relative location of nearby objects.
- 4) **Mobility.** Any given handset when in motion versus stationary will present radically different measurements for location computation.
- 5) **Path Loss.** Path loss prediction models are only a very coarse estimate of what the statistical loss would be for a given geographic area and usually do not model the effects of man-made obstructions. This type of precise modeling would be required to produce even a gross level of what the expected path losses would be for a particular area- and only in a broad statistical sense. The level of path loss

predication accuracy needed to support location estimates is orders of magnitude more precise than what could be predicted from simulated path loss calculations. In addition, path loss can be severely affected by the following items: antenna polarization angle due to the orientation and beam pattern, seasonal effects (foliage), fading and signal nulling caused by scattering rays from both near and far reflective objects, elevation above terrain, and interference from other signals in same or near-by cells.

- 6) Limitations of Handset RSSI measurement capabilities – Typical measurement errors could be in the order of +/- 5 dB.

### **3.3. RSSI Location Mapping Based on Measurements Is Impractical**

Such location mapping is extremely impractical due to the requirement of periodic re-calibration over potentially huge geographic areas. A comprehensive database should include all areas from which 911 calls can be made, including sidewalks, parks, alleys, parking lots, garages, access roads, inside buildings, etc. Additionally, such activity requires three dimensional and seasonal mappings. Elevation changes and foliage conditions can present large variations in signal path loss. Also, this approach is highly ineffective for slow-moving<sup>6</sup> or stationary mobiles<sup>7</sup> due to fading.

## **4. SIGMAONE'S CARRIER AUDITED TRIALS DEMONSTRATE ACCURACY TWO TIMES BETTER THAN THE "EXPECTED ACCURACY" OF MNLS**

AT&T has stated that the MNLS "will offer accuracy levels slightly below those required under the Commission's rules for network based technologies"<sup>8</sup>. AT&T further suggests that achieving accuracies of 250m-67% and 750m-95% will provide public safety with significant benefits. Recent filings by APCO and NENA as well as carrier audited trials conducted by SigmaOne have proven that viable options exist which meet the FCC's requirements for accuracy.

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<sup>6</sup> G. Ott, "Vehicle Location in Cellular Mobile Radio Systems", IEEE Trans. On Veh. Tech. P.43-46, Fed. 1977

<sup>7</sup> H.L.Song, "Automatic Vehicle Location in Cellular Communication Systems", IEEE Trans. On Veh. Tech. Pp.902-908, Nov. 1994.

<sup>8</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules - April 4<sup>th</sup> 2001, page 12,

The AT&T filing includes a white paper, much like a concept document typically prepared at the beginning of a long-term development effort. As such AT&T does not attempt to conclusively present a detailed technical rationale for the accuracy levels to be delivered by MNLS, nor does it provide any audited real world test data to substantiate its claims across multiple environments. It should also be noted that none of the infrastructure vendors that filed in support of AT&T's waiver request were willing to support the accuracy and deployment schedule suggested by AT&T.

#### **4.1. SigmaOne's Audited Carrier Trial Results**

The primary objective of SigmaOne's carrier-audited trials was to evaluate the performance and functionality of SigmaOne's beta location system in a variety of operational scenarios and typical Suburban, Urban and Rural environments (For a more comprehensive analysis of these trials please refer to exhibit B of this filing). The wireless carrier and SigmaOne conducted these field tests in order to validate SigmaOne's initial assessment of achievable performance for its Sigma5000 commercial AMPS/TDMA (IS-136) location system. The system's performance was evaluated and verified in the three environments under a wide range of call scenarios, for both AMPS and TDMA (IS-136). SigmaOne and the wireless carrier teams jointly determined the test scenarios immediately prior to each stage of the tests.

During these three trials, SigmaOne recorded location data from 2,713 calls. Approximately 30 % of the calls placed during the Suburban trial, and 50% of the calls placed during the urban trial were placed deep inside buildings ranging from 1 to 6 story buildings in the Suburban environment, to high-rise urban canyon office buildings in the urban environment.

The test results in Table 2 and Table 3 below clearly demonstrate that even with beta system hardware and initial versions of the location algorithms used at the time of the test (March – December 2000) the Sigma5000 system met the 67% FCC mandate in all suburban environments and fully met the 95% requirement throughout the compiled environments. Most importantly, even when subjected to rigorous test environments that included urban canyons, high-rise office buildings, hangars, underpasses, bridges, and

parking garages, the SigmaOne beta system attained a compiled accuracy across all environments of 110m-67 %. This represents accuracy two times better than AT&T has claimed for its still unproven MNLS solution. Furthermore the Sigma5000 accurately and consistently provided location information for calls placed in the AMPS mode (just under 50% of the trials). Results in AMPS were similar to the accuracy results obtained in TDMA (IS-136).

**Table 2 - Audited trials – Summary results 67%**

	Suburban	Urban Canyon	Rural	Compiled Result <sup>9</sup>
AMPS – 67%	95 m	125 m	247 m	114.7 m
TDMA – 67%	85 m	140 m	255 m	110 m

**Table 3 - Audited trials - Summary results 95%**

	Suburban	Urban Canyon	Rural	Compiled Result <sup>10</sup>
AMPS – 95%	200 m	321 m	556 m	254 m
TDMA – 95%	175 m	314 m	582 m	236 m

## **5. ANTENNA IMPLEMENTATION ISSUES ASSOCIATED WITH NETWORK BASED SOLUTIONS**

In its waiver request, AT&T describes its trial in Denver and states, “The (Denver) trial demonstrated that there are substantial challenges associated with use of

<sup>9</sup> Based on the assumption – 75% of calls suburban, 15% urban, 10% rural

<sup>10</sup> Based on the assumption – 75% of calls suburban, 15% urban, 10% rural

AOA antennas. AOA antennas are physically large (4' by 4' panels), and caused substantial loading/capacity problems for some existing base stations, requiring removal and replacement of the support structure....In addition, the size, of AOA antennas generated opposition and concern on the part of property owners (the landowners from whom AT&T rents land for its base stations) and zoning authorities.”<sup>11</sup>

The SigmaOne AOA antenna arrays, are less than 1/6<sup>th</sup> of the size<sup>12</sup> quoted by AT&T in its waiver request. The SigmaOne antennas were designed to be minimal in size and weight and unobtrusive (please refer to Table 4 for antenna dimensions). We therefore believe that the impacts associated with such antenna installations are negligible and constraints on any zoning regulations are minimal. Deployment of SigmaOne's AOA antenna arrays in a wide variety of suburban, rural and urban cell sites as well as in both omni and sectorized configurations has demonstrated its operational flexibility in real world environments. None of these installations have required special zoning permits.

If zoning or the concerns of property owners becomes an issue, SigmaOne's system could be deployed without AOA until the issue was resolved. The SigmaOne system combines both TDOA and AOA technology, and therefore does not require all of the carrier's sites to be equipped with AOA antennas.

Although AT&T raises the issue of zoning for AOA antennas it has successfully deployed more than 10,000 cell sites throughout the United States. The construction and deployment of each of these sites would appear to constitute a significantly greater challenge than the low profile type of AOA antennas developed by SigmaOne.

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<sup>11</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 9.

<sup>12</sup> See Photo of antenna in Exhibit B to this filing



**Table 4 - SIGMA 5000 - AOA Antenna Array Mechanical Specifications**

Parameter	Specifications
Dimensions (L x W)	34.68" x 9.29"
Weight	18 lbs.

## **6. AT&T'S PROPOSED WAIVER REQUEST BASED ON MNLS IS NOT COMPARABLE TO VOICESTREAM'S WAIVER**

AT&T uses the Voicestream waiver and resulting performance guidelines for NSS as a benchmark for its waiver request. The basis for these two waiver requests is very different. VoiceStream's NSS was presented as an interim solution. As AT&T clearly admits, "AT&T does not currently plan to discontinue service over its TDMA network on a date certain as a result of its transition to the GSM air interface."<sup>13</sup>

Following the early deployment of NSS, VoiceStream committed to deploy E-OTD across its entire footprint by the first quarter of 2002<sup>14</sup>. In contrast, AT&T's proposed MNLS solution will remain the only available location solution for millions of its TDMA wireless subscribers for years to come. Even AMPS, a standard first deployed over 15 years ago continues to represent a significant share of the wireless traffic in the United States.

### **6.1. Implementation:**

Unlike AT&T's MLNS concept, NSS is a relatively mature, standards based GSM solution developed and implemented by many GSM infrastructure providers. Although AT&T claims that its MNLS concept is standards based, the activities of the TR 45.2 Committee have not and do not specifically address the infrastructure

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<sup>13</sup> AT&T Wireless Services, Inc. – Partial Response of AT&T Wireless Services Inc. to order of the Wireless Telecommunications Bureau, May 30<sup>th</sup> 2001, page 6

<sup>14</sup> VoiceStream Report on implementation of Phase II ALI – November 9<sup>th</sup>, 2000, page 14

modifications that will ultimately be required for MNLS to evolve into an end-to-end solution. Moreover, it remains unclear whether any of AT&T infrastructure vendors have committed to either a specific implementation schedule or the accuracy performance criteria. While Ericsson supports the waiver request in principle<sup>15</sup>, it did not provide any clear implementation and deployment plan or technical support for the accuracy or the deployment claims made by AT&T. MNLS would require all of AT&T's infrastructure vendors (Lucent, Nortel and Ericsson) to independently develop and deploy MNLS. To-date none of these vendors have publicly announced their plans to commercialize this technology.

## **7. AT&T'S CLAIM OF UNIQUE BENEFITS FOR MNLS ARE UNSUBSTANTIATED**

AT&T states in their waiver request that the "the difference in accuracy performance among the various options is not substantial enough to outweigh the overwhelming customer and public safety benefits offered by MNLS."<sup>16</sup> The waiver then includes the following as examples of public safety benefits offered by MNLS. All of these "unique benefits" are also inherent to the SigmaOne location system as well as *all other network based technology solutions*. In fact, of the eight "Advantages"<sup>17</sup> stated in the MNLS white paper, there is no single advantage that is unique to MNLS.

**AT&T Claim:** "Without the need for new handsets."<sup>18</sup> AT&T claims that MNLS does not require new handsets.

The use of Network Based location systems proposed by SigmaOne and other technology vendors does not require any change to the existing and/or future AMPS and TDMA handsets.

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<sup>15</sup> Ericsson Inc; Comments of Ericsson – May 7<sup>th</sup> 2001

<sup>16</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 12

<sup>17</sup> "Mobile-Assisted Network Location System (MNLS) Overview," AT&T Wireless Services, Inc. – Request For Waiver of the E911 Phase II Location Technology Implementation Rules,, Exhibit G, pages 7-8.

<sup>18</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 12

**AT&T Claim:** The MNLS solution is “comparable” to those of other Network Based solutions AT&T has investigated.

AT&T easily dismisses the performance achieved by network-based solutions without committing itself to specific results or demonstrating truly comparable accuracy. For example, AT&T claims that MNLS will offer accuracy levels “slightly below” those achievable with Network Based Solutions. Yet at the same time AT&T speaks only of “estimated”, “expected” and “approximate accuracy” that it will be able to deliver.

SigmaOne’s carrier audited AMPS/TDMA field trials unequivocally demonstrate that the SigmaOne beta location system clearly met the 67% FCC requirement in Suburban environments, fully met the 95% FCC requirement across all environments and achieved 110m–67% accuracy when test results were compiled across all environments (suburban, urban and rural) including in-building, outdoor, stationary and mobile scenarios.

**AT&T Claim:** The unique circumstances facing AT&T as a result of its deployment of the GSM air interface makes it highly impractical for AT&T to implement a traditional network overlay solution on its TDMA network. “...the enormous outlay of resources that would be required to accomplish two complete network overlays at the same time simply is not justified by the minimal difference in location accuracy levels offered by other network based technologies in comparison to MNLS”<sup>19</sup>

Many location systems, including the Sigma5000, utilize software radios as the primary radio receiver module used to receive and measure the handset transmission signals. The location base station unit is typically air interface agnostic and could support a multitude of air interfaces. Support for different air interfaces are determined by air interface specific DSP code and host CPU software. (The Sigma5000 currently supports both an Analog and Digital air interface). The Sigma5000, through its OSS module, could easily and centrally (from a Network Management Center) download the necessary changes to the DSP and Software codes in order to support the transition of the carrier’s cell site location base station from TDMA to GSM on an as required basis.

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<sup>19</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 12

***AT&T Claim:*** The MNLS system will permit PSAPs to request updated location information during the duration of the emergency call

Several network based location systems including the Sigma5000 have ability to provide location updates as required. The SigmaOne system is also capable of monitoring the 911 call for handoffs and provide continuous or per-request location updates for these calls even in the absence of the J-STD-036 infrastructure upgrade.

***AT&T Claim:*** The accuracy of the solution likely can be improved with on-going enhancements to the algorithms and the location grid.

These ongoing improvements are not just theoretical for SigmaOne. They have already been demonstrated in practice. See Exhibit B.

***AT&T Claim:*** MNLS is a fully standards compliant solution, currently in the process of being adopted

Many Network Based solutions including the Sigma5000 are fully standard compliant.

***AT&T Claim:*** AT&T can deploy the MNLS system very rapidly across the entire country Furthermore a national deployment of network based location systems would require significant resources to deploy.

It is clear that the deployment of location systems on a nation-wide basis will be challenging. The challenge of rapid deployment is not, however, new to wireless carriers. Many location solution vendors, including SigmaOne, have entered into the appropriate third party agreements with installation and integration companies that have both the resources and experience to ensure efficient and timely installation of systems. Moreover, SigmaOne as well as other location vendors including Grayson, and TruePosition have developed planning and optimization tools designed to facilitate rapid deployment of their systems.

Wireless carriers have successfully overcome these deployment issues through advanced planning, long term commitments and orders and close cooperation between vendors and carriers. The widespread deployment of network based location solutions is achievable within a timeframe that the public safety community will be able to absorb and effectively utilize. Expediting deployment of any network solution can be accomplished by the timely placement of orders. AT&T Wireless has stated that they have been involved in “countless vendor meetings, technology conferences, and site visits during 1999, 2000 and 2000...”<sup>20</sup> As a result, they have been given adequate advanced notice of the necessary timeline requirements and delivery schedules from major location vendors.

Rapid deployment of network based location systems will also be dependent on the maturity, reliability and maintainability of major system elements. Over the past two years SigmaOne and other location technology providers have migrated their location platforms from a beta stage to commercial grade. As such, many of the issues and concerns described by AT&T in their test reports have already been addressed by SigmaOne as well as other providers. The truth is, unless wireless carriers commit themselves to begin deploying these systems under real world conditions, all of these concerns will certainly be moot. Based on their own experience in deploying new and complex wireless systems, carriers understand all too well that reliability and maintainability improvements can only come from the experience that vendors obtain in real world deployments.

**AT&T Claim:** “Service to roamers and un-initialized callers”<sup>21</sup> – AT&T Wireless claims that MNLS can provide service to roamers and un-initialized callers.

All Network Based Solutions including SigmaOne’s provide service to roamers and un-initialized callers.

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<sup>20</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 6.

<sup>21</sup> AT&T Wireless Services, Inc. – Request for Waiver of the E911 Phase II Location Technology Implementation Rules- April 4<sup>th</sup> 2001, page 12.

## **8. CONCLUSIONS**

Given the poor accuracy to be expected from the MNLS solution, the absence of any public commitment from AT&T's network vendors in terms of performance and a realistic deployment schedule, it would be unfortunate if systems already developed, tested and available for deployment by several major location companies were simply discarded in favor of a theoretically unsound and unproven technology that may be less expensive or easier to deploy. The public's right, and in particular, the right of millions of AT&T's AMPS and TDMA subscribers to receive timely emergency services as well as the operational requirements of 6,000 PSAPs throughout the US struggling to deliver emergency 911 services to the carrier's subscribers, calls for a higher standard. As the FCC has suggested in its ruling of September 8 2000, wireless carriers must be required to do more than just the absolute minimum. The selection process by which carriers ultimately adopt and deploy location solutions such as SigmaOne's or those of other location technology providers, must be determined by what is truly best for both the wireless consumer and those responsible for delivering life saving E911 services. Even though many of the issues revolving around the Phase II mandate are driven by cost, we cannot forget that it is the average consumer that will either benefit or suffer from the Commission's decision. After five years of hard work its is now up to the Commission to ensure that accurate location technologies are finally deployed that meet both the letter and the spirit of the Phase II E911 mandate.